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| 09/769,446 | 01/26/2001 | Rajendra K. Shenoy | FON 103 | 3770 |

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EXAMINER

SHRIVASTAV, BRIJ B

ART UNIT PAPER NUMBER

2859

DATE MAILED: 11/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/769,446

Applicant(s)

SHENOY, RAJENDRA K.

Examiner

Brij B Shrivastav

Art Unit

2862

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 January 2003 and 31 May 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12, 14-16 and 18-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 11, 12, 14-16, 18 and 23-31 is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) 19-22 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 15.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's petition to withdraw the abandonment has been granted and entered.
2. Applicant's amendment and arguments dated January 14, 2003 and May 31, 2002, in response to the Office action dated January 15, 2002 have been received and fully considered. However, applicant's arguments against rejection of claims 1-10 are not persuasive. In response to applicant's arguments, stated on pages 8 (last paragraph) and page 9 (first paragraph), Liu et al teach a magnetic resonance imaging apparatus and method showing a human object being imaged (figure 1A, column 1, lines 7-57, numeral 14). Liu et al also teach application of polarizing magnetic field (figure 1A numeral 12), and magnetic field gradients (figure 1A, numeral 22, the direction of gradient fields are shown by x, y, and z arrows). Further, Liu et al teach application of RF energy according to a fast spin echo technique, which is clearly shown in figure 1A by numeral 26, and figure 7). Furthermore, Liu et al's use of RF pulses shown in figures 6 and 7 and statement in column 8, lines 9 and 10, if not explicitly, strongly implicates subsequent application of RF energy to the imaging object according to a driven equilibrium technique. Claims 2-10 stand rejected as before, as they are dependent on rejected claim(s). Applicant's argument's on pages 9, second and third paragraphs and page 10 are moot, as applicant has cancelled claims 13 and 17, and in this Office action claims 11, 12, 14-16, 18, and 23-31 are being allowed, and claims 19-22 are being objected, as they are dependent on rejected claim(s).
3. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu et al (US 5,742,163).

As regards to claim 1, Liu et al teach an NMR imaging process and apparatus where an imaging object is subjected to an uniform magnetic field (figure 1A, numerals 12, 14), and magnetic field gradients (figure 1A, numeral 20; column 4, lines 9-13). Further, Liu et al apply RF energy to the imaging object according to a fast-spin echo technique (figures 2, 6 and 7, shown as RF), and subsequently they also apply RF energy to the imaging object according to a driven equilibrium technique (figure 6; column 8, lines 9-19)

As regards to claim 2, Liu et al further teach detection of magnetic resonance signals emitted by the imaging object (figure I A, numeral 38; column 4, lines 36-44).

As regards to claim 3, Liu et al further teach a fast-spin echo technique using multi-echo NMR imaging sequence (figures 6 and 8; column 8, lines 9-19 and 30-38).

As regards to claims 4 and 5, Liu et al further teach multi-echo NMR imaging sequence having a plurality of echoes (figure 6, numerals 62's) with each of the plurality of different echoes or at least one of the plurality of different echoes is coded differently (figure 6, numerals 56' and 64'; 64's are phase encoding blips)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 6-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al (US 5,742,163) as applied to claims 1 and 3, and further in view of Zur (US 4,893,081).

As regards to claims 6 and 7, Liu et al do not teach a 90-degree RF pulse at the center of any of the plurality of different echoes, and the pulse having a phase so that the magnetization of the imaging object is forced in the direction of the uniform magnetic field. However, Zur teaches a 90 degree RF pulse at the center of a plurality of echoes,

and it has a phase to force magnetization of the imaging object in the direction of the uniform polarizing magnetic field (figure 3, numeral 54).

It would have been obvious to one of ordinary skill in the art to adapt Zur's multi-image pulse sequence pulse with the imaging technique of Liu et al to decrease imaging time and improve signal to noise ratio to further improve image quality.

As regards to claims 8-10 Liu et al do not teach multi-echo NMR imaging sequence having a first 90-degree RF pulse followed by a series of 180-degree RF pulses, and these pulses include n 180-degree pulses, providing n echoes, and also, a second 90-degree RF pulse at a center of the nth echo is applied to orient magnetization parallel to the uniform polarizing magnetic field. However, Zur teaches multi-echo NMR imaging pulse sequence having a first 90 degree RF pulse followed by a series of 180 degree RF pulses (figure 3, numerals 51, 54, 62) and 180 degree RF pulses include n 180 degree pulses which are followed by n echoes (figure 3, numerals 54, 62 and 68a, b), and a second 90 degree RF pulse at a center of nth echo to orient magnetization of the imaging object in the direction of the uniform polarizing magnetic field (figure 3, numeral 54, second 90 degree RF pulse).

It would have been obvious for one with ordinary skill in the art to combine Zur's pulse sequence with the pulse sequence of Liu et al to shorten the time for imaging and improve signal to noise ratio to further improve image quality.

6. Claims 19-22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

REASONS FOR ALLOWANCE

7. The following is an examiner's statement of reasons for allowance:

Claims 11, 12, 14-16, 18, and 23-31 are allowed, as the prior art of record does not teach nuclear magnetic resonance process utilizing application of RF of 180-degree RF excitation pulses following the 90-degree RF excitation pulse; and applying a second 90-degree RF excitation pulse following the sequence of 180-degree RF excitation pulse, wherein, each 180-degree RF excitation pulse in the excitation sequence generates a spin echo, and at least one spin echo is encoded differently than another spin echo obtained by the application of the sequence, in combination with the remaining limitations of the claims.

8. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brij B Shrivastav whose telephone number is 703-305-0649. The examiner can normally be reached on 7 AM to 4 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego F. F. Gutierrez can be reached on 703-308-3875. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0956.



Diego F.F. Gutierrez
Supervisory Patent Examiner

Bbs
October 29, 2003

CHRISTOPHER W. FULTON
PRIMARY EXAMINER